Bandwidth can be dolled out in any desired increments to users. The bandwidth can even be controlled down to the port on a switch.

**[0100]** The specification above has explained the advantageous functionality provided in the Open IP Services Platform 30. However, a critical aspect of this invention is the ability to utilize a plurality of Open IP Services Platforms 30 in a coordinated manner, and in a new network topology.

**[0101]** The traditional tree structure of many networks, including the Internet, is shown in figure 6. Figure 6 is a block diagram illustrating the functional design of the traditional tree network architecture. This type of network is referred to as a centralized distribution model. The centralized distribution model is like the branches of an up-side down tree, the branches spreading out below, and coming together to a single trunk 70 at the top. The centralized distribution model inherently suffers from scalability issues.

**[0102]** Consider the trunk 70 to be a trunk line to the Internet. Every node below the trunk line 70 must access the Internet by passing data through it. Furthermore, if

a node 72 wants to communicate with a node 74, the communication must pass through branch line 76. It should be easy to see from figure 6 that local network traffic will often travel the same data paths as nodes that are communicating with the trunk line 70 and the Internet. The result can be saturation of communication lines.

**[0103]** Figure 7 is provided as an illustration of the problems that occur when there is a saturated communication line 80. Consider two nodes 82 and 84. The first node 82 is utilizing 40 Megabytes of bandwidth, and the second node 82 is utilizing 60 Megabytes of bandwidth. On a 10/100 MB per second network line, that means that nodes 82 and 84 have taken up all the available bandwidth for all the nodes 86 that must use communication line 80 to transfer data. No bandwidth is available at all for the remaining nodes 88. Accordingly saturation or network congestion by only a few nodes can eliminate access for many nodes.

**[0104]** An illustration of one such problem with the tree network architecture is that the network is vulnerable to common network hacking problems such as denial of service (DOS) attacks. Unfortunately, DOS

attacks are a part of the Internet that are not likely to go away anytime soon. Even well-protected and well-funded sites can be brought down by a hacker of limited experience by flooding a node with IP service requests. The present invention would inherently resist such attacks by providing many more pathways to any node in a switch fabric network matrix. Furthermore, even if a single node is successfully flooded, all adjacent nodes should not be affected because there is no single communication line that would become saturated. Thus, an Internet site that is mirrored on other nodes is more likely to remain operational, at least on a limited basis.

**[0105]** Another scalability issue concerns mass storage. Mass storage is still expensive when dealing in large quantities. For example, a terabyte capacity mass storage system can cost millions of dollars. Unfortunately, the centralized distribution model generally requires that mass storage be disposed at a single node.

**[0106]** Another issue related to mass storage is having a service that many nodes desire to access. For example, consider video-on-demand. Under the present centralized distribution model, video-on-demand is not a service that